

by the thought that the miraculous complexity of physics will prove it to be an exciting and open field for research for many, many years to come.

Physics and Biology

If there is a fundamental complexity in nature as revealed in the biological sciences, there is no *a priori* reason why this complexity should not invade physics. In fact we have seen that physics is not the obvious, commonsense, naive science that it was once thought to be. The simple, static billiard ball like conception of the electron is far from the truth.

The elemental units of life involve a large number of atoms. Their great complexity is a matter of organization. On the other hand, the difficulty in formulating a theory of the electron and the other elementary particles, lies in their ultimate simplicity. In the study of the elementary particles our space-time concepts, our physical intuitions, our familiar thought patterns, fail us. The methods and devices which are so useful as aids to our understanding of macroscopic matter are no longer applicable. This wavering, vibrating, and trembling happening which is the electron has not the properties of matter as we know or experience it. The failure to project the electron on the space-time curtain of physics, on which events of the physical world are assumed to be portrayed, makes the attempt to understand its existence so difficult. One can now see that in order to understand the origin of matter one needs go beyond matter.

It is interesting to note that at a time when there is a trend in physics toward greater and greater abstraction, there is a tendency in the opposite direction in the biological sciences. We are finding mechanisms for biological phenomena at a time when we are discarding them for physical phenomena. Activities which are associated with living matter, in fact, with the highest form of living matter—man—and which are of teleological nature can now be mirrored by appropriate mechanical systems. The investigations of Wiener and his school in cybernetics have revealed a striking analogy between the behavior of modern calculating machines which exhibit properties akin to memory, association, and choice, and the human brain, when it is functioning. Our nervous systems have also been found to behave like a mechanism with negative feedback properties. Surely it would seem that the mystery of matter is just as legitimate a connotation as the mystery of life.



NOTES

from ABROAD

The Netherlands

In a previous letter I described the slow birth of the Netherlands Foundation for Pure Research. I mentioned that, in spite of the fact that the bill about the foundation has not yet passed Parliament, the provisional council of the foundation has not delayed its activities. The Sub-Foundation for Research on Matter has been at work for three years.

The Foundation for Research on Matter found its first task after the liberation in promoting nuclear physics. During the war the nations occupied by Germany lagged seriously behind in nuclear physics in comparison with their more fortunate allies. It was realized in Holland that it would put a very high strain on the nation's hampered resources and scientific manpower if an attempt should be made to catch up within a few years; so after long discussions the foundation decided to concentrate upon promoting modest nuclear research programs at the different universities and upon establishing a new cyclotron laboratory in cooperation with the Municipal University of Amsterdam and with the Philips Works. The researches thus promoted by the foundation consisted largely in perfecting and developing instruments and accessories for nuclear research, including counters of various types, counter circuits, ionisation vessels, Wilson chambers, and beta-ray and mass spectrographs. Rather small scale research with radioactive substances and with neutrons is carried out in Groningen, Amsterdam and Utrecht, while in Leyden, nuclear magnetic resonance and nuclear relaxation are investigated.

In the new Amsterdam Laboratory for Nuclear Research, the cyclotron secretly built during the war at the Philips Works has been mounted. The eighty kilowatt magnet has a pole diameter of seventy-two inches. With a pole gap of thirteen inches it gives a central field of thirteen and a half kilo-oersted. The apparatus is being adjusted as a syncho-cyclotron for accelerating deuterons and alpha particles to thirty and sixty electron volts respectively. A department of radiochemistry is attached to the laboratory.

In principle the Foundation for Research on Matter does not wish to confine itself to the promotion of nuclear research. The University of Leyden and the Institute of Technology of Delft have developed a research program concerned with the physics of metals (crystal growth, electric, elastic and mechanic properties of metals).

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